EB

RESTRICTED CIRCULATION

THIS PAPER IS NOT AN OFFICIAL DOCUMENT; IT IS FOR INFORMATION ONLY AND MUST NOT BE QUOTED IN ANY PRINTED PUBLICATION

Agricultural Memorandum 719

Some Effects of Site Changes at East Malling Research Station

by

J Cochrane

Because of projected expansion of the glasshouse area at East Malling in the vicinity of the existing meteorological enclosure at National Grid Reference TQ 711 568, 37 metres above mean sea level, it was decided in 1972 to establish a new enclosure at National Grid Reference TQ 708 570, 32 metres above mean sea level, some 350 metres towards the north west. Records of temperature - air, soil and earth - and rainfall were maintained at both sites for the 25 month period August 1972 to August 1974 when the permanent change to the new site was made on 1 September 1974.

Readings were always taken at the standard (old) site first and those at the new site some 10 minutes later. The following notes on the effects of the site change are based on monthly values and the actual differences between such values recorded at the two sites are tabulated in the Appendix.

Rainfall

Rainfall totals at the two sites are very similar and any slight differences may well be due to the 10 minute difference in observation time on occasions when precipitation was occurring at that time.

Air Temperatures

1. Average monthly maxima and monthly highest maxima are generally slightly lower at the new site. Average differences over 25 months are 0.12°C (SD 0.10) and 0.22°C (SD 0.21) respectively. Although there is a suggestion of greater effect in spring and summer, the differences do not show enough consistency to justify more than a simple correction of - 0.1°C to each monthly value to adjust the old site averages of mean maximum to the new site.

2. Average differences for average and lowest monthly minimum temperatures are - 0.05°C (SD 0.16) and - 0.22°C (SD 0.50) respectively. Again there is a tendancy to greater effect in spring and summer but not consistent enough to justify anything more than a correction of + 0.1°C to the old site averages of mean minimum.

3. Effectively, the old site averages of monthly mean air temperatures can be applied to the new site without adjustment although the mean diurnal range will be about 0.2°C less at the new site.

4. There is a suggestion in the number of frosts recorded that the new site is more liable to frost in autumn and winter and experiences fewer frosts in spring. The period is too short, however, to prove any significant differences in occurrences of so local a phenomenon as frost.

Soil/Earth Temperatures

1. Soil temperature differences at 10 cm and 20 cm are probably due as much to the combined effects of an unconsolidated new site and the 10 minute difference in time of observation as to any real difference in soil characteristics.

2. In the case of earth temperatures at 30, 50 and 100 cm there is a systematic, and probably real, difference between the 2 sites as a result of slightly different soil properties.

Monthly mean values at each level for both sites can be represented by curves of the form

$$T = a_0 + a_1 \cos \frac{2\pi}{12} t + b_1 \sin \frac{2\pi}{12} t$$

(where t = o is mid-August etc), such that between 96% and 97% of the variance is accounted for in each case. Values of the coefficients are:-

	30 cm		50 cm		100 cm	
	New	Old	New	Old	New	Old
a_0	10.53	10.15	10.84	10.34	10.85	10.39
a_1	6.50	5.98	6.38	5.78	5.69	5.21
b_1	-2.57	-2.07	-2.17	-1.58	-0.99	-0.58

Based on these curves, the suggested corrections to the old site averages are:-

	J	F	M	A	M	J	J	A	S	O	N	D	
30 cm	0.9	0.6	0.2	-0.1	-0.3	-0.3	-0.2	0.2	0.6	0.9	1.1	1.0	°C
100 cm	0.9	0.7	0.3	0.1	-0.2	-0.2	0.0	0.2	0.6	0.8	1.0	1.1	°C

3. Damping depth, ie the depth at which the amplitude of the annual temperature curve becomes 0.37 times the amplitude at the surface, is about 315 cm for the new site and 340 cm for the old one. The lag in penetration of the annual temperature maximum is about 2½ days at 30 cm and 3½ days at 50 and 100 cm.

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
Bracknell

EB

Appendix to Agricultural Memorandum 719

Differences (old-new) between old and new sites (monthly values) at East Malling

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall													
New site	1972								99	100	101	97	97
as % of old	1973	98	102	98	98	100	104	97	98	101	104	102	100
	1974	99	101	97	101	100	99	101	93				
Air temperatures													
Mean Maximum													
	1972								-0.1	0.0	0.0	0.0	0.1
	1973	0.1	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.1
	1974	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1				
Highest Maximum													
	1972								0.0	-0.1	0.2	0.0	0.0
	1973	0.1	0.4	0.5	0.5	0.5	0.4	0.0	0.1	0.2	0.2	0.0	0.1
	1974	0.0	0.5	0.4	0.5	0.5	0.2	0.3	0.0				
Mean Minimum													
	1972								0.0	-0.2	0.2	0.1	0.2
	1973	0.0	0.2	-0.1	0.1	0.0	-0.2	-0.2	-0.3	-0.3	0.0	0.0	0.0
	1974	0.1	0.0	0.0	-0.2	-0.2	0.0	-0.3	-0.2				
Lowest Minimum													
	1972								-0.3	-0.3	1.4	0.4	-0.1
	1973	-0.5	0.2	-0.1	-0.1	-0.5	-0.4	-0.5	-0.8	-0.3	0.1	-0.1	0.0
	1974	0.0	0.1	-0.3	-0.7	-0.3	-0.5	-1.4	-0.4				
No of air frosts													
	1972										-1	-2	-1
	1973	1	-2	3	1	0					1	-2	-1
	1974	-2	-1	0	1	0							
No of ground frosts													
	1972									-1	-1	0	-5
	1973	1	0	0	0	-1	-1				-2	0	-4
	1974	-2	-1	1	0	0			1				
Soil/Earth Temperatures													
10 cm	1972								-0.3	-0.2	-0.1	-0.1	0.0
	1973	-0.1	0.0	0.1	0.2	0.0	0.1	-0.3	0.0	0.3	0.2	0.0	0.0
	1974	0.0	0.1	0.2	0.2	0.4	0.8	0.1	0.2				
20 cm	1972								-0.6	-0.4	-0.2	-0.1	0.0
	1973	-0.1	0.1	0.0	-0.1	-0.2	-0.6	-0.9	-0.5	-0.4	-0.4	-0.3	-0.2
	1974	-0.2	-0.2	-0.1	-0.2	-0.5	-0.1	-0.5	-0.6				
30 cm	1972								-1.0	-0.7	-0.1	0.1	0.1
	1973	0.0	0.0	0.0	-0.2	-0.8	-1.5	-1.2	-0.9	-0.4	0.1	0.3	0.3
	1974	0.2	0.1	0.0	-0.4	-1.0	-1.1	-1.0	-1.0				
50 cm	1972								-1.1	-0.8	-0.3	0.1	0.1
	1973	0.1	0.0	-0.2	-0.4	-1.0	-1.8	-1.7	-1.1	-0.5	0.1	0.4	(0.1)
	1974	(0.1)	0.1	0.0	-0.5	-1.2	-1.3	-1.2	-1.1				
100 cm	1972								-0.3	-0.9	-0.5	-0.1	-0.1
	1973	-0.1	-0.1	-0.2	-0.4	-0.8	-1.4	-1.4	-1.1	-0.7	-0.1	0.2	0.3
	1974	0.1	0.1	-0.1	-0.5	-0.9	-1.2	-0.9	-1.1				